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events in the history of the mammalian stocks.

The bulk of the book is taken up by a summary of the extinct mammals; first those without the placenta (Eplacentata), or the marsupials, including the Allotheria or multituberculates, the African *Tritylodon*, *Ptilodus* and *Polymastodon* of North America, and the various types described by Ameghino from Patagonia. After these comes a discussion of the diprotodont marsupials in Australia and South America, while the triconodonts are included with the polyprotodont types. Placental mammals embrace the Pantotheria or trituberculates and all forms above them, of which the insect-eating types or Insectivora are the most primitive; the author also includes under this head the unique Tillodonta, *Tillotherium* and its rare allies, whose position in the mammalian scheme is very doubtful. The relationships of the creodonts and fissipede Carnivora are clearly set forth, after which Abel describes the ancient whales.

The group of edentates are discussed under two distinct heads, the Xenarthra or "poor-toothed" mammals of South America, and the Nomarthra, those of the Old World, of which there are relatively very few. Rodents are briefly dismissed, the curious horned types, *Epigaulus* and *Ceratogaulus*, of the Miocene of Colorado and Kansas being emphasized as the most remarkable.

The hoofed mammals are always the most conspicuous and numerous forms in every fossil fauna, and to them the greater part of the volume under consideration is devoted. Twelve orders are recognized, of which the first is the "Stammordnung" Protungulata, embracing all of the forms usually included under the order Condylarthra and certain additional families such as the Pantolambdidae, here considered as ancestral to the Amblypoda instead of being placed under that order as is the usual custom. The Bunolitopternidae, ancestral to the Litopterna, are also placed here.

Following the ungulates, the primates are discussed, but a very brief section only is given to fossil man.

The final chapter of the book is upon the rise, dominance and decline of the mammalian stem. Of particular interest is the author's discussion of the causes of extinction, great emphasis being laid upon the possibility of contagious diseases having an extensive influence in the extinction of faunas.

Altogether the book is a well-balanced production which avoids excessive technicalities but gives a very good general idea of the more essential facts of mammalian anatomy, classification and relationships as disclosed by paleontology. It shows, moreover, how necessary for systematic work in recent zoology an adequate knowledge of extinct animals has become. An interesting commentary upon the advancement of paleontological science is afforded by the fact that the great bulk of illustrative material is drawn from American authorities and based upon the fossil resources of the New World.

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#### THE VEGETATION OF THE NEBRASKA SAND HILLS

THE average traveler regards the prairies and plains as regions of extreme monotony; particularly is this true if his way takes him through a region of sand hills. The total incorrectness of this view is admirably illustrated by the publication of Professor Pool's researches in the Nebraska sand hills.<sup>1</sup> From an earlier and semi-popular presentation by the same author we had learned to know something of the fascination and scientific interest of these dynamic landscapes, and now we have his detailed results.<sup>2</sup>

The Nebraska sand-hill country covers an area of about 18,000 square miles, that is, nearly a fourth of the area of the state. There are similar but smaller areas of sand hills in Kansas, Colorado and the Dakotas. The soil

<sup>1</sup> "A Study of the Vegetation of the Sand-hills of Nebraska," Raymond J. Pool. *Minn. Bot. Stud.*, III., 4: 189-312, pls. 15, figs. 16, map 1, 1914.

<sup>2</sup> "Glimpses of the Great American Desert," Raymond J. Pool. *Pop. Sci. Mon.*, 80: 209-35, figs. 17, 1912.

is composed of dune sand, probably derived from the Loup Fork (Tertiary) beds. These hills seem to have been formed largely at some previous epoch and to have become stabilized and occupied by vegetation. Through the influence of man, mostly on account of prairie fires and overgrazing, many of these ancient dunes have become rejuvenated to the detriment of those responsible for it.

After giving the results of his careful measurements of wind, rainfall, evaporation, temperature and other ecological factors, Professor Pool takes up in detail the vegetation of the region. It is a pleasure to note the author's caution in using the word "formation." He rightly believes in using this term only for large units, referring the "formations" of many authors to associations. The characteristic upland formation is the prairie-grass formation, which is contrasted sharply with the short-grass formation of the plains, the two embracing most of the great climatic grasslands between our eastern forests and the mountains. These two great formations have similar physiognomy, but different component species; the limiting factors are the available water and competition, and not temperature, as supposed by Merriam. The chief association is the bunch-grass association, dominated especially by *Andropogon scoparius*; this is the vegetation that prevailed generally before the advent of the white man, and is regarded as the temporary climax of the region. The vegetation of this association is open, the grasses occurring in tufts or bunches, but it is supposed that ultimately some closed prairie-grass association will prevail. There is evidence of this in the spear grass association (dominated by *Stipa comata* and *Koeleria cristata*), and farther west in the grama-buffalo grass association (dominated by *Bouteloua* and *Bulbilis*).

Doubtless the most interesting features of the sand hills are the blow-outs. These are retrogressive features and are due, as noted above, especially to prairie fires and overgrazing. At first through the death of the plants there are small patches of bare sand. Later the sand is scooped out by the wind,

forming conical or crateriform depressions, known as blow-outs. As the sand is scooped out, more sand falls in from the sides, so that the blow-out is increased in circumference, as well as in depth. Extreme cases are recorded where the depth may be as much as 100 feet and the circumference 600 feet. When wind erosion becomes checked, vegetation again gets a foothold, the chief pioneers being *Redfieldia flexuosa*, *Psoralea lanceolata* and *Calamovilfa longifolia*. After a time these pioneers are followed by the bunch-grass association; after this vegetational changes are much less rapid. One of the chief features of interest in the woodland formations along the streams is the overlap of the deciduous eastern forest and the yellow pine (*Pinus ponderosa scopulorum*) forest of the west. The lowland formations are much like those elsewhere, as to both content and succession, except that a meadow type represents the temporary climax; probably one of the more eastern of the prairie grass associations represents a more ultimate condition.

Professor Pool is to be congratulated on his thorough and sane treatment of his problem. His contribution is solid and satisfying, and is a pleasant contrast to the many ephemeral disquisitions which even yet masquerade too frequently under the name of ecology.

H. C. COWLES

#### SPECIAL ARTICLES

##### THE EFFECTS OF SMALL REPEATED INTRAPERITONEAL INJECTIONS OF WITTE'S PEPTONE SOLUTIONS IN GUINEA-PIGS<sup>1</sup>

THE experiments reported in this preliminary paper form a group in a series which has been planned to determine the organic effects of parenteral introduction of certain substances which may be produced within the tissues of an organism, or which may be absorbed from the gastro-intestinal tract. The fact that Longcope<sup>2</sup> has reported that parenteral diges-

<sup>1</sup> From the laboratories of the Cincinnati General Hospital and the department of pathology of the University of Cincinnati.

<sup>2</sup> Longcope, *Jour. Exp. Med.*, 1913 (18), 678.